



Invasive and Exotic Species Management in Denali National Park and Preserve

2011 Summary Report

Natural Resource Data Series NPS/DENA/NRDS—2011/220



ON THE COVER

Volunteers conduct manual treatment efforts targeting common dandelions (*Taraxacum officinale ssp officinale*) during the annual Dandelion Deveg project.

Photograph by: Wendy Mahovlic, NPS

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Eric Walter

National Park Service
Denali National Park & Preserve
P.O. Box 9
Denali Park, AK 99755

Wendy Mahovlic

National Park Service
Denali National Park & Preserve
P.O. Box 9
Denali Park, AK 99755

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The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data. Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols.

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Contents

	Page
Figures.....	v
Tables.....	v
Abstract.....	vi
Introduction.....	1
Methods.....	3
Results.....	5
Overview.....	5
Species Specific Accomplishments	6
Narrowleaf hawksbeard (<i>Crepis tectorum</i>).....	6
Narrowleaf hawkweed (<i>Hieracium umbellatum</i>).....	7
Foxtail barley (<i>Hordeum jubatum</i>)	7
Yellow toadflax (<i>Linaria vulgaris</i>).....	8
White and yellow sweetclover (<i>Melilotus albus</i> , <i>M. officinalis</i>).....	8
Common dandelion (<i>Taraxacum officinale</i> ssp. <i>officinale</i>)	8
Invasive clovers (<i>Trifolium repens</i> , <i>T. hybridum</i> , and <i>T. pratense</i>)	9
Scentless false mayweed (<i>Tripleurospermum inodorum</i>).....	9
Bird vetch (<i>Vicia cracca</i>)	10
Preventative Actions.....	11
Revegetation	11
Education and Outreach.....	12
Concerns	13
Future Goals.....	13
Literature Cited	15

Contents (continued)

	Page
Appendix 1 - Invasive Plant Policy of Denali National Park	17
Topsoil Transportation.....	17
Revegetation of Disturbed Land.....	17
Seed Collection and Range of Use	18
Equipment Inspection for Use Within the Park.....	18
Gravel and Borrow Pit Inspections.....	18

Figures

	Page
Figure 1. Map of the Park Road in Denali National Park.	1
Figure 2. Narrowleaf hawksbeard infestation at the sewage lagoon.	6
Figure 3. Narrowleaf hawkweed.	7
Figure 4. Foxtail barley.	7
Figure 5. Yellow toadflax.	8
Figure 6. White and yellow sweetclover.	8
Figure 7. Common dandelion.	8
Figure 8. Red clover.	9
Figure 9. Scentless false mayweed.	9
Figure 10. Bird vetch.	10
Figure 11. Bird vetch infestations in the entrance area of Denali National Park.	10

Tables

	Page
Table 1. Summary of Denali National Park & Preserve Exotic Plant Management Team accomplishments.	5
Table 2. Species specific monitoring and control efforts during the 2011 season.	6

Abstract

This report describes the work performed by the Alaska Exotic Plant Management Team at Denali National Park & Preserve during the 2011 field season. The 2011 Exotic Plant Management Team at Denali National Park & Preserve comprised of two Student Conservation Association interns including one International SCA from Japan and one National Park Service employee. For the eighth consecutive year invasive plant inventory and control efforts were performed within the park. Efforts were focused on disturbed areas with high traffic use which consist of park entrance trails, park infrastructures, and areas along the Park Road corridor. Infestations of invasive plants were mapped using a Trimble 2005 GeoXT, and controlled using manual hand-pulling techniques often with the help of park volunteers. Data was edited and analyzed using GPS Pathfinder Office and ArcGIS. The team mapped, vouchered, and verified two invasive plant species that were new to the DENA WRST data set. These species are black bindweed (*Fallopia convolvulus*) and hempnettle (*Galeopsis bifida*). Education and outreach initiatives were also undertaken within the park, most notable being labeling of planter boxes at the Teklanika rest stop and presentations given at park wide employee trainings. Total canopy acres controlled in 2011 (12.3) were slightly lower than in 2010 (16.711), due mainly to a reduction in the number of person hours and volunteer crews available for treatment efforts. A total of 290.592 acres of the park and 23.395 acres of non-park lands were surveyed in 2011.

Introduction

In an effort to protect and conserve the unique wilderness of Denali National Park and Preserve (DENA), the Alaska Exotic Plant Management Team (EPMT) systematically monitors, inventories, and conducts management efforts on invasive plants within and around the park. The 2011 season is the eleventh year in which invasive plants have been inventoried and the eighth year in which the Alaska EPMT has conducted management efforts to control invasive plants in DENA. Through documentation made via Global Positioning System (GPS) mapping, manual removal, educational outreach, and native seed collection for revegetation projects, the DENA EPMT continues to monitor, inventory, and eliminate invasive weeds and promote the preservation of native species within the park.

Due to the largely intact ecosystems found in DENA, invasive plants tend to establish infestations in localized disturbance associated with high-traffic areas of the park, mainly through human activity vectors. These areas consist mainly of the park entrance trails and infrastructure areas, as well as along the Park Road corridor. Uninhibited, these infestations could eventually expand and spread into more remote locations of the park, presenting a significant threat to native vegetation, and in turn, the ecological health of the area. The DENA EPMT strives to locate and treat invasive species in early stages of establishment and prevent future infestations by following well established best management practices.

The DENA EPMT prioritizes invasive plant control efforts in the park based upon a number of factors. One such factor is the overall ability of the DENA EPMT to effectively control a given infestation before it has a chance to spread. The DENA EPMT emphasizes prevention and early detection for this reason. Areas most likely to have new infestations are repeatedly surveyed throughout the growing season. These areas are primarily within the park between the George Parks Highway park entrance and the Denali Visitor Center (Figure 1). When detected early, hand pulling a new isolated infestation is more likely to prevent the spread and establishment of an invasive species. A larger, well established infestation is much more difficult to manage.

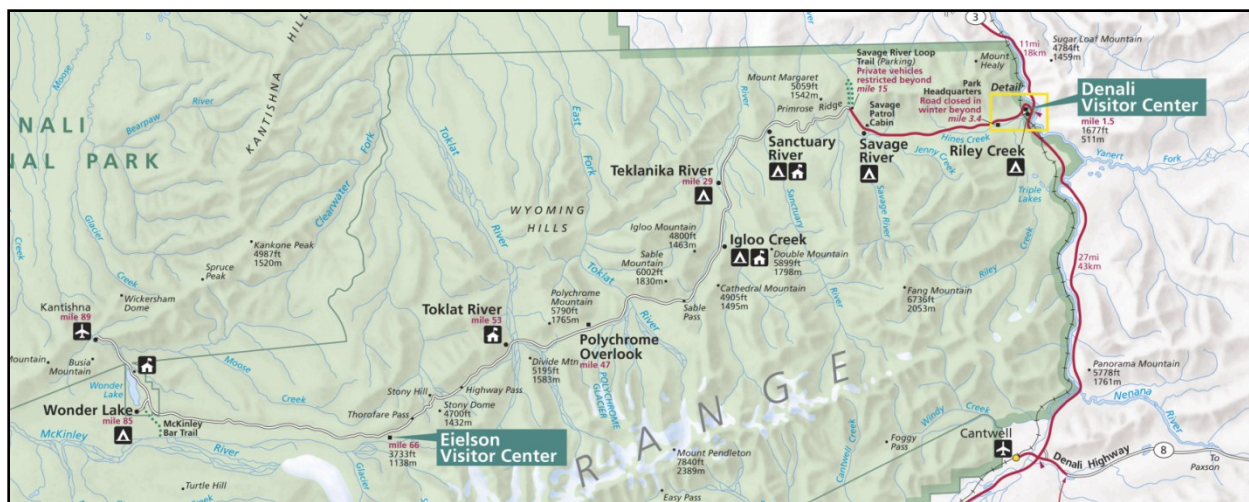


Figure 1. Map of the Park Road in Denali National Park.

Another factor that is considered when prioritizing control of invasive plants in DENA is the Alaska invasiveness ranking. The Alaska Natural Heritage Program (AKNHP) provides a ranking list of many invasive plants found in Alaska. A numerical value is assigned to create a relative ranking for each invasive plant considered. The values range from one to 100 with one denoting the lowest potential impact and 100 indicating the highest potential impact on Alaska ecosystems (Carlson et al 2008).

Methods

The DENA EPMT systematically monitors areas with high potential for invasive species introduction. These areas include park infrastructure areas and entrances, the Park Road corridor, established campgrounds, and ongoing construction projects located within the park. Specific problem areas include the recently constructed Denali Visitor Center campus, the Park Railroad Depot, the George Parks Highway roadsides near the Park Entrance, and the roadsides along the first mile of the Park Road. The recently developed area of Glitter Gulch outside the park boundary is also monitored, where a large portion of park visitors choose to lodge. These areas are undoubtedly the most impacted from human traffic and activity. Inventory and control efforts were mapped using a Trimble handheld GPS and edited using GPS Pathfinder Office according to the 2011 Alaska EPMT Field Protocol (Million and Rapp 2011). Past infestations of invasive plants are revisited and monitored in the same way.

Control work to remove the invasive plants was conducted manually with hand tools such as dandelion diggers, trowels, and shovels. The removed plants were immediately bagged and then burned at a later date. DENA EPMT collected unknown plant specimens for proper identification. Specimens were also collected and submitted to the park herbarium for species that previously had not been documented within the park.

The DENA EPMT prioritized efforts based upon various pertinent factors. These factors include the possible impact that a certain invasive species can have on Alaska ecosystems. The Alaska Natural Heritage Program (AKNHP) has produced a ranking system for invasive plants which assigns point values to invasive species based upon their ability to spread and impact Alaska ecosystems (Carlson et al. 2008). The DENA EPMT uses this guide to both identify unknown weeds and to prioritize control efforts. Paired with this ranking system, DENA EPMT assesses the size and establishment of an infestation. Due to constraints of time and human resources, a large infestation of a lowly ranked invasive may be overlooked for management in favor of treating small, isolated infestations of species that can spread to the backcountry quickly. Early detection of these new infestations is a major goal of the DENA EPMT as early treatment is much more effective and efficient than trying to manage a large infestation with a substantial seed bank.

In addition to control efforts, DENA EPMT undertakes restoration and revegetation projects. These projects are conducted in an effort to both restore native vegetation to disturbed areas and to discourage the establishment of invasive plant infestations. These projects include collecting seeds from native wildflowers and grasses, planting collected seeds, and care/maintenance of transplanted trees and tundra mats. Revegetation efforts have been shown to reduce the amount of invasive plant observations after completion of construction projects

Results

Overview

During the 2011 season, DENA EPMT staff surveyed over 313 species acres for invasive plants. 36.576 species acres were infested with invasive plants. Of those 36.576 acres, 12.3 species acres were treated. Most invasive plants are located along Denali Park Road or in the developed areas. The season's efforts are summarized in Table 1 below.

Table 1. Summary of Denali National Park & Preserve Exotic Plant Management Team accomplishments.

Year	EPMT Personnel		Volunteer Crews		Total Person Field Hours	Invasive GPS Data NPS Lands(non-NPS lands)		
	# pers.	Field Hours	# pers.	Field hours		Species Acres Surveyed	Species Acres Infested*	Acres Treated
2004	1	39	1	25	64	2.553 (6.557)	0.934 (6.557)	0.450 (0.035)
2005	1	224	8	544	768	16.713 (2.321)	12.877 (1.531)	3.261 (0.186)
2006	1	454	8	679	1,133	750.313 ¹ (2.958)	16.866 (0.349)	10.211 (0.121)
2007	2 ²	743	16	1,173	1,916	805.951 ¹ (7.826)	11.329 (0.301)	8.368 (0.289)
2008	2 ²	626	10	454	1,080	741.687 ¹ (11.982)	12.750 (7.968)	11.051 (0.649)
2009	2 ²	571	5	385	956	749.459 ¹ (4.210)	20.437 (0.317)	11.370 (0.317)
2010	3 ³	1,893	16	2,560	4,453	159.034 (35.245)	16.766 (2.616)	14.125 (2.586)
2011	3 ⁴	764	3	143	907	290.592 (23.395)	29.348 (7.228)	10.290 (2.010)

* Acres infested is calculated by acres mapped multiplied by the percent cover in areas greater than 0.5 acres. If under 0.5 acres, acreage mapped is counted as 100% cover.

1-This acreage includes the actual road surface of the Denali Park Road.

2-Includes one SCA intern

3-Includes two SCA interns

4-Includes one SCA intern and one international SCA intern

Two new invasive species were found in the park this season, black bindweed (*Fallopia convolvulus*) and hempnettle (*Galeopsis bifida*). Only a few individual plants of these species were found and they were immediately pulled. These species were located in the Kantishna Horse Corral, which had been used in the past to house concessionaire owned horses. This area is a hotbed for invasive introduction and is monitored regularly. DENA EPMT visited this site three times in the 2011 season. Night-blooming cockle (*Silene noctiflora*) was also found at the Horse Corral this season, confirming a historic collection in the AKEPIC database.

On a positive note, tremendous results were observed in a few well established infestations. Patches of tall white sweetclover (*Melilotus albus*) along the George Parks Highway contained far fewer individuals than in the past. Treatment of these areas was reduced to only about 1 hour, in contrast with multiple days of treatment by large groups of volunteers in years past. This shows that past treatment efforts have been productive and effective. Also, this season's observations show that past chemical treatments targeting narrowleaf hawksbeard (*Crepis tectorum*) in the sewage lagoon have significantly reduced infestations size.

Species Specific Accomplishments

The DENA EPMT treated 16 different species during the course of the 2011 field season. Table 2 contains a brief summary of those species, where they were found, and the associated size of each infestation and treatment area. Summaries of management actions for specific species are included also in this section.

Table 2. Species specific monitoring and control efforts during the 2011 season.

Species		AKEPIC Rank	Location*	Invasive GPS Data	
Latin Name	Common Name			Acres Infested ¹	Acres Treated
<i>Crepis tectorum</i>	Narrowleaf hawksbeard	56	F, PH, PK, TD	6.696	5.997
<i>Descurainia sophia</i>	Flixweed	41	PK	0.032	0.008
<i>Erysimum cheiranthoides</i>	Wormseed wallflower	--	PK	0.007	0
<i>Hieracium umbellatum</i>	Narrowleaf hawkweed	51	PH	0.548	0.392
<i>Hordeum jubatum</i>	Foxtail barley	63	F, PH, PK, TD	6.325	0.174
<i>Linaria vulgaris</i>	Yellow toadflax	69	PH, TD	0.506	0.379
<i>Lupinus polyphyllus</i>	Bigleaf lupine	71	PK	0.003	0.003
<i>Leucanthemum vulgare</i>	Oxeye daisy	61	PH	0.001	0.001
<i>Melilotus albus</i>	White sweetclover	81	F, PH, TD	1.629	1.610
<i>Melilotus officinalis</i>	Yellow sweetclover	69	PH	0.003	0.003
<i>Plantago major</i>	Common plantain	44	F, PK, TD	1.855	0
<i>Fallopia convolvulus</i>	Black bindweed	50	PK	0.001	0.001
<i>Taraxacum officinale ssp. officinale</i>	Common dandelion	58	F, PK, TD	17.679	2.836
<i>Trifolium spp.</i>	Alsike, red and white clover	57/53/59	F, PH, PK	0.872	0.684
<i>Tripleurospermum inodorum</i>	Scentless false mayweed	48	TD	0.018	0.018
<i>Vicia cracca</i>	Bird vetch	73	F, PH, PK, TD	0.403	0.213

* F = front country, PH = George Parks Highway (AK Route 3), PK = park road, and TD = train depot.

¹ Acres infested is calculated by acres mapped multiplied by the percent cover in areas greater than 0.5 acres. If under 0.5 acres, acreage mapped is counted as 100% cover.



Figure 2. Narrowleaf hawksbeard infestation at the sewage lagoon.

Narrowleaf hawksbeard (*Crepis tectorum*)

Narrowleaf hawksbeard is one of the higher priority invasive species targeted by DENA EPMT (Figure 2). While the AKNHP only gives this species an invasiveness ranking of 56, it has been deemed high priority due to the size and location of infestations in DENA. Narrowleaf hawksbeard was introduced to the park in the sewage lagoon and has spread along the roadsides for about the first mile of the Park Road. This infestation was mapped and pulled during weekly sweeps along the road. The frequency of the sweeps is necessary due to the thin, small size of the plants which makes them difficult to locate unless flowering.

Narrowleaf hawksbeard has also been located in other areas of the DENA frontcountry, including the Railroad Depot and the revegetated mound at the Power Plant located between the Denali Visitors Center (DVC) parking lots and the Murie Science and Learning Center (MSLC). Narrowleaf hawksbeard has been found in the bus driver parking lot near the MSLC. This area was pulled during the weekly sweeps until July 8th due to the late blooming of this particular infestation, making correct identification difficult. This species is currently limited in distribution and, diligent treatment is necessary to prevent further infestations within the park. DENA EPMT pulled 40 pounds of narrowleaf hawksbeard this summer.

This species was also treated with herbicides in the fenced area of the sewage lagoon was in 2009 and the immediate area surrounding the fence in 2010. Monitoring of these areas in 2011 showed great success with treatment efficacy. The area should be carefully monitored in the future as a large scale construction project to improve the lagoon area started late in the season.

Narrowleaf hawkweed (Hieracium umbellatum)

Differentiated from narrowleaf hawksbeard by a lack of basal rosette and sturdier, thicker stem structure, narrowleaf hawkweed has been assigned an invasiveness ranking of 51 (Figure 3). Narrowleaf hawkweed is more difficult to pull than narrowleaf hawksbeard, but is much less widespread in the park. Only one infestation was located this season, at mile 231.75 of the George Parks Highway, which was mapped and treated.



Figure 3. Narrowleaf hawkweed.

Foxtail barley (Hordeum jubatum)



Figure 4. Foxtail barley.

Foxtail barley is a nuisance species which is considered native to Alaska (Figure 4). It has invasive characteristics and has been spreading quickly through disturbed areas of the park. Due to time and human resource constraints this species moved to a lower priority for DENA EPMT this season. DENA EPMT only treated infestations of areas in early stages of revegetation. 82 pounds of foxtail barley was pulled up this season from a revegetation site at mile four. Foxtail barley would spread quickly in these locations and lower the success rate of revegetation efforts. Foxtail barley also presents a unique issue to this park in particular as it possesses a small barb on its seed structure. This barb can cause parts of the plant to lodge itself in the digestive tract of animals, if ingested. This is not believed to be a concern for wildlife of the park, but poses a threat to the health of DENA's sled dogs. Staff of the park kennels have been instructed to pull foxtail barley in the kennel areas.

Yellow toadflax (*Linaria vulgaris*)

Yellow toadflax, with an invasiveness ranking of 69, is another high priority species for treatment in DENA (Figure 5). Only one infestation was documented this season, located along the railroad tracks at the Railroad Depot. Yellow toadflax requires extensive digging to remove as it grows from a complex rhizomatous root structure. This infestation is especially difficult to treat due to safety constraints and stony soil. DENA EPMT pulled four pounds of plant material from this infestation this season. A total of four hours was spent pulling this invasive this season.



Figure 5. Yellow toadflax.

White and yellow sweetclover (*Melilotus albus*, *M. officinalis*)



Figure 6. White and yellow sweetclover.

With an invasiveness ranking of 86 and 69 respectively, white sweetclover and yellow sweetclover are designated as high priority for treatment and control efforts in DENA (Figure 6). Established infestations of these species have been observed along sections of the George Parks Highway, including mile 232 and in Glitter Gulch at the base of the Kingfisher Creek road sign. In past years, DENA EPMT spent many hours with multiple volunteers treating these infestations. This season, these infestations were significantly smaller and required about 1 hour of treatment total. Isolated individuals and small infestations inside the park at the Railroad Depot and other various front country locations were revisited and retreated this season as well. DENA EPMT pulled 45 pounds of sweetclover this season.

Common dandelion (*Taraxacum officinale* ssp. *officinale*)

The DENA EPMT organizes an annual two week volunteer treatment event to target common dandelion within the park, known as the Dandelion Deveg (Figure 7). Normally, one week is spent pulling dandelions in the entrance area and at the eastern end of the Park Road and one week is spent camping with volunteers at the western end, in the Kantishna area. This season's Dandelion Deveg was reorganized due to the unexpected planning and construction of a watering system at the old Kennels Road revegetation project. Volunteers devoted June 9th and 10th to pulling dandelions on the eastern end of the park, resulting in 35 pounds of plant material pulled. The week of June 13-18 was spent at the west end of the park and yielded 105 pounds of pulled plant material.



Figure 7. Common dandelion.

Dandelions are undoubtedly the most widespread invasive plant in DENA. Infestations are common throughout the front country and isolated infestations are sporadic along the road corridor in the backcountry. The Kantishna area also contains multiple infestations along roadsides and the airstrip. They grow mainly on disturbed areas inside the park and rarely spread into areas with established native species. Though dandelions pose a minimal threat to the backcountry of the park, they are still considered a moderate priority species for treatment due to the ability of visitors to relate to this species as a problem weed. Dandelions are moderately difficult to pull since they possess the ability to sprout from root fragments. Removing the root requires the use of digging tools.



Figure 8. Red clover.

Invasive clovers (Trifolium repens, T. hybridum, and T. pratense)

These three clovers range in invasiveness rankings from 53 to 59. Treatment of these clovers is often difficult and time consuming due to the high density of infestations and a shovel is often required. While infestations are quite common throughout the DENA Visitor Center campus and headquarters, DENA EPMT has designated it low priority due to time and human resource constraints. Only one infestation was treated this season located at the Kantishna Horse Corral (Figure 8). 50 pounds of clover species were pulled, although large amounts of dirt were inadvertently weighed as well.

Scentless false mayweed (Tripleurospermum inodorum)

Scentless false mayweed, with an invasiveness ranking of 54, is found in only one location in the park, along the tracks immediately south of the Railroad Depot (Figure 9). This infestation has been treated in the past and will continue to be a high priority in regards to treatment. This daisy-like flower is easily pulled, due to shallow roots. This season, DENA EPMT pulled one pound of scentless false mayweed at this infestation. In 2010, DENA EPMT pulled five pounds at this location (Evans, C., and P. Knapick 2010) and 20 pounds in 2009 (Byrne, J., and W. Mahovlic 2009). This shows that manual treatment of this area has been effective in reducing its size.



Figure 9. Scentless false mayweed.



Figure 10. Bird vetch.

Bird vetch (Vicia cracca)

With an invasiveness ranking of 73, bird vetch has been deemed as high priority for DENA EPMT treatment efforts (Figure 10).

Infestations of bird vetch inside DENA tend to be small but time consuming to treat. Bird vetch grows from a complex rhizome system which can be extremely difficult to remove in the rocky, dry soil which is characteristic to the entrance area of DENA. Due to the difficulty of treatment past infestations are revisited, thoroughly inventoried, and treated if necessary. Early detection is key in the management of this species and therefore specifically considered whenever conducting inventories. Infestations in the DENA front country at Glitter Gulch, at Fannie Quigley's cabin in Kantishna, and at mile 231.75 of the George Parks Highway were revisited and retreated this season. Past infestations behind the McKinley Chalet and the McKinley Village were not detected this season and mapped as such. A past infestation near the C-camp

propane field was not detected; however, a new individual plant was found and treated within the propane field. New infestations were found in the State pullout on the George Parks Highway adjacent to the Nenana River and along the Park Road between the Wilderness Access Center and railroad tracks. Another infestation was found in the RV Park in the Canyon at mile 240 on the George Parks Highway. DENA EPMT pulled 200 pounds of Bird vetch this season, some of the weight is contributed to dirt as it was found more successful to dig up the plant and as much of the roots as possible.

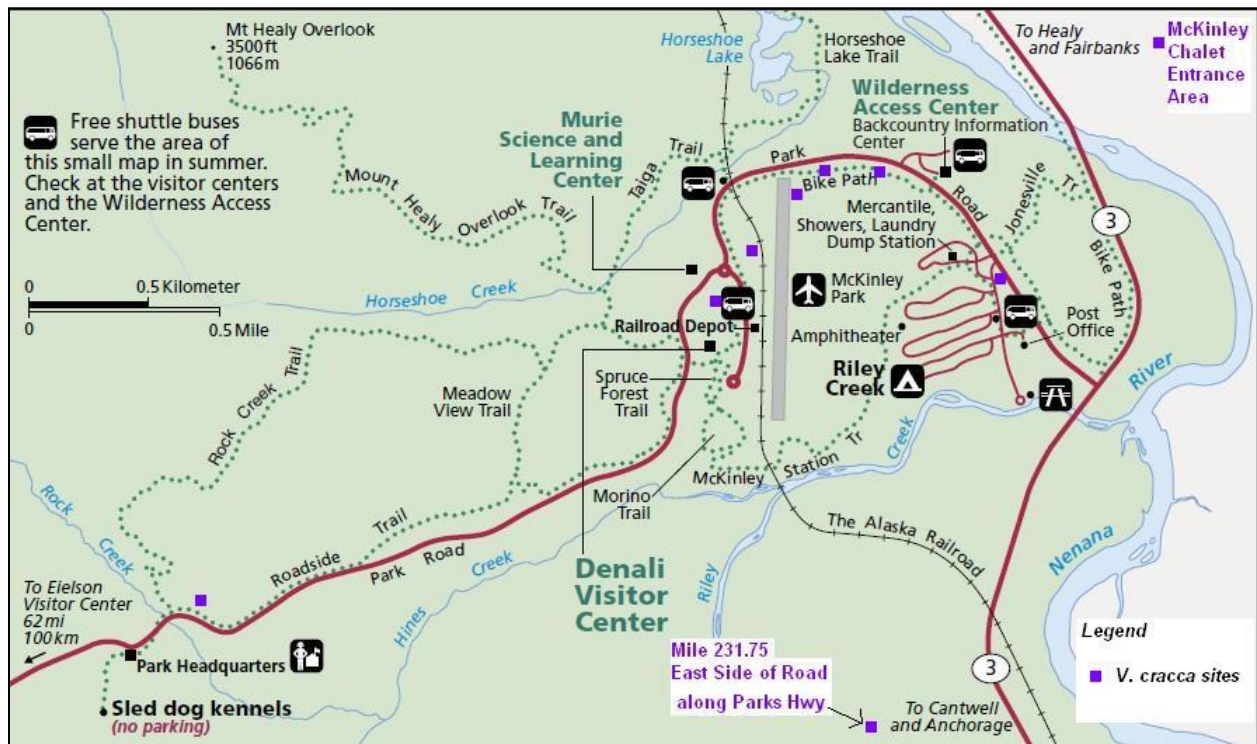


Figure 11. Bird vetch infestations in the entrance area of Denali National Park.

Preventative Actions

Preventative action can play a large part in avoiding establishment of invasive plants. DENA EPMT conducts inspections of construction equipment before being used for projects in the park. This inspection process reduces the possibility of invasive seeds being brought into the park in dirt clumps attached to mud flaps, tires, and other various areas of large equipment. The DENA EPMT inspected 11 pieces of construction equipment this season. DENA EPMT also inspects gravel pits from which fill is brought into the park for construction use for invasive plants. DENA EPMT inspected three local gravel pits this season and went up to Fairbanks to inspect a source for topsoil which will be used in the permanent housing area. DENA policy regarding these inspections can be found in Appendix 1.

Revegetation

DENA revegetation efforts encourage the growth of native species in disturbed areas where invasive species are more likely to establish. Projects include the collection and dispersal of native seeds, salvage and relocation of tundra mats, and transplanting of spruce trees. The tundra mats and transplants are taken from construction sites where they would otherwise be removed and burned or tilled into the soil. They are then stored and eventually transplanted when the opportunity presents itself.

This season, over 50 hours of DENA EPMT time was devoted towards maintenance of last year's transplantation projects. These transplants, located in the Sewage Lagoon Drainage Corridor (Waste Water Treatment Plant), Concession Land Assessment (CLA) construction site, the Emergency Services Building (C-Camp area), Old Kennels Road, and new Kennels Bus Turnaround, required frequent watering due to the low precipitation levels during the 2011 field season. Watering was carried out multiple times using a mobile 500 gallon tank with an attached hose and pump. On June 30, DENA EPMT constructed a sprinkler system for the Old Kennels road revegetation project. Hopefully, a similar system will be set up at the Sewage Lagoon, preventing runoff and more adequately watering the salvaged plant materials. Each time these areas were watered they were mapped as a restoration polygon. On July 8th, DENA EPMT trained a small group of Trail Crew staff in how to perform watering tasks. Following this training session, the trail crew workers watered transplants twice a week throughout the end of the season.

Need For Seed is the annual seed collection volunteer effort in which native grass and flower seeds are collected for revegetation purposes in the future. This year the east end Need for Seed occurred from August 8th thru August 10th. Six volunteers spent 144 hours collecting 18 lbs. of un-cleaned seeds.

- *Hedysarum alpinum*: 4 lbs.
- *Hedysarum mackensii*: 6lbs.
- *Agropyron sp.*: 4 lbs.
- *Oxytropis campestris*: 2 lbs.
- *Various*: 2 lbs.

Need for Seed on the west end of the park occurred from August 15th thru August 19th . Five volunteers spent 200 hours collecting seeds for future construction projects that will happen from Mile 50 – 92. They collected 10 lbs. of un-cleaned seeds.

- *Hedysarum alpinum*: .5 lbs.
- *Hedysarum mackensii*: 1 lb.
- *Agropyron sp*: 4 lbs.
- *Various*: 4.5 lbs.

Native seed planting at the Waste Water Treatment Plant Outfill area was completed on August 22, 2011. One EPMT member, one SCA, and two DENA employees spent a total of 24 hours organizing, scarifying, planting, and raking the seeds. Seeds planted were: *Hedysarum alpinum*, *Agropyron sp.*, and *Oxytropis campestris*. Unfortunately, all of the other construction projects that need seeds are not completed yet so they will be seeded next season.

Education and Outreach

Education and outreach opportunities provide greater awareness of the issues associated with invasive species and the threats they pose to the park. Education of DENA employees proves especially beneficial, as employees can keep an eye out for new infestations during their daily tasks. This season, for example, the bus drivers in the park alerted us to a few new infestations of narrowleaf hawksbeard and dandelions near the bus storage lot and along the park road at Igloo Canyon respectively.

On May 13th and June 2nd a DENA EPMT member gave an invasive plant presentation during the training of the concession ARAMARK bus drivers and the DENA interpretive staff. The presentation identified eight of the worst invasive species that DENA has and gave suggestions as to what can be done about the problem. In total over 200 people attended the two trainings.

This season, dandelion diggers (complete with pulling instructions) were placed in the recreation halls of the seasonal housing complexes of the park, near bus parking areas, and at the helicopter landing pad. Park employees and bus drivers were urged to use these tools to pull dandelions in and around these housing developments. Not much feedback was given about these efforts; however, this effort recruited one volunteer that spent a day pulling dandelions in the headquarters area. He pulled 20 pounds of plant material.

Identification nameplates were placed in two planters identifying roughly 30 native shrubs, trees, grasses, and wildflowers of the park tundra at the Teklanika rest stop. The nameplates provide an educational experience for park visitors as they travel through the park, helping them to understand the diversity of the parks plant life.

Concerns

DENA has undertaken a large number of major construction projects this season. The disturbance of these large areas presents opportune habitat for invasive species. These areas must be closely monitored in the future. Projects include the Kennels Road re-route, the Wastewater Treatment Facility Rehabilitation, the Emergency Services and Law Enforcement building adjacent to C-Camp, the CLA building, and the Road Widening Project starting at mile 76 on the Park Road. The road widening project is of special concern, as known infestations of common dandelion were covered this season by project fill deposits before they could be pulled. These infestations will most likely re-emerge in the future.

Future Goals

- Continue inventory and control efforts of known infestations within the park.
- Repeat inventories of high traffic areas of the park with special consideration for bird vetch, sweetclover, and narrowleaf hawksbeard.
- Continue to perform inspections of construction equipment and gravel pits.
- Monitor, revegetate, and inventory DENA construction projects upon completion.
- Continue to collect native seeds for future revegetation projects
- Continue to monitor and maintain transplants at current revegetation projects.
- Conduct an inventory along the southeastern corner of the park, looking for orange hawkweed (*Hieracium aurantiacum*) which has been found in Talkeetna, but not yet in DENA. Also, an inventory should be conducted at the Talkeetna airstrip which is commonly used by aircraft that enter the park.
- Consider certain infestations for future chemical treatment, namely infestations of bird vetch and yellow toadflax. These species should be considered due to the large amount of time and effort they require to remove by hand and the persistence of infestations after years of hand treatment.

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Appendix 1 - Invasive Plant Policy of Denali National Park

September 2008

Topsoil Transportation

- Top priority – no invasive plants or seeds contained within the topsoil.
- Can transport topsoil from the west end of the park to the east end of the park as most invasives are at the east end. Not recommended to transport topsoil from the east end to the west end. There are exceptions to this as there are some invasive plants at the west end. An example is the horse corral in Kantishna. There are several invasive plants in that area that are not seen anywhere else in the park.
- No mileage limitation.
- Important to make sure that the surrounding area where the topsoil is taken from is free of invasive plants and seeds.
- Saving topsoil from the disturbed site to put back when the project needs it is a good policy – if feasible.

Revegetation of Disturbed Land

- Disturbed land in the park must be revegetated with native species from within a 20 mile radius of where the disturbance is.
- Revegetation may occur with native tundra mats, native transplants, native seedlings, native cuttings, bioengineering techniques with native plants, and native seeds.
- Instructions on how to revegetate using the materials above are found in the “Native Plant Revegetation Manual for Denali National Park and Preserve” by Roseann V. Densmore.
- Revegetation with native species must occur to keep the ecosystem intact.
- One of the most important procedures before using any of the revegetation methods is scarifying the soil. Soil compaction is the cause for most of the unsuccessful revegetation projects (luckily, there aren’t many of those!!!!).
- Fertilizer is not used in the Front Country front country projects as it makes the invasives grow as much or more than the native plants or seeds.
- Fertilizer was used at the Primrose turn-around (mile 17) with no detrimental effects.
- After the native tundra mats or native plants are planted it is ESSENTIAL to water, water, water – especially if it is a dry summer.
- Saving tundra mats and transplants before the site is disturbed is good policy if they are free of invasive plants – if feasible. The tundra mats at Eielson were saved for three years on pallets and are doing marvelously after being transplanted in May and June of 2008.

Seed Collection and Range of Use

- Collection of native plant seeds for revegetation concerns may occur within a 20 mile radius of the disturbed area - inside and outside of the park. This is to protect the genetic integrity of the plants.
- Seeds are collected, cleaned, and planted by hand thereby making them very precious.
- Seed needs for a project can take up to several seasons to collect, so prompt communication with the revegetation technician about any maintenance projects that need seeds is vital to the success of native seed planting. Joe D. informed the revegetation technician six years before the new Denali Visitor Center needed seeding. That was a sufficient amount of time to be able to collect all the seeds needed for such a large project.
- When planting the native seeds, annual rye is used in the mix. This provides almost instant greening of an area and helps diminish the possibilities of invasives taking hold. Native seeds can take up to three or four seasons to become established and invasives can invade in one season. Annual rye is also used to stabilize slopes.

Equipment Inspection for Use Within the Park

- Construction companies that are going to be using their equipment within the park boundaries need to have it pressure washed and inspected before bringing it in the park. Hopefully, this will diminish the spread of invasive plants within the park. This includes species that have already taken hold in parts of the park (common dandelion) and others that have not arrived here but are in Anchorage and Fairbanks or the lower 48.
- When inspecting equipment, one looks in all the nooks and crannies of the rig, looking for clumps of dirt, mud, or gravel that might be harboring invasive seeds which range in size from smaller than a pinhead to several inches. Inspecting the tires or treads is also very important as seeds can “hitch-hike” on the rubber or metal as well as the axils. The parts of the equipment that are closest to the ground are most likely the areas that will transport the invasive seeds, but the entire piece of equipment needs to be inspected.
- If the equipment does not meet the standards of the inspector, the piece must be taken to be pressure washed again and re-inspected.

Gravel and Borrow Pit Inspections

- Any pit that is outside the park and is used to store or extract soil, gravel, or any other material to or from the park needs to be inspected. This is to insure that the equipment going to/from the pit stays invasive free (as it has already been inspected) and the material in the pit that is coming to the park is invasive free.
- When inspecting a pit, one looks for invasives not only in the pit, but on the road entering the pit and all areas surrounding it. If any invasives exist, it depends on the species of invasive as to what happens next. If the invasive is of the variety in which the seeds can stay viable for up to 80 years (such as *Melilotus albus* or *M. officinalis*), then the pit will fail inspection. If the seeds are not that variety, the invasives can be pulled by the inspector (if there are not that many) or the owner of the pit should pull them and the pit can be inspected again.